

## CLAIMS

**1. A fuel cell system comprising:**

a fuel cell having a fuel electrode supplied with fuel gas and an air electrode supplied with oxidizer gas;

5 a carbon dioxide separator separating carbon dioxide from anode exhaust gas expelled from the fuel electrode of the fuel cell; and

a fuel vaporizer producing fuel gas by injecting fuel into the anode exhaust gas, whose carbon dioxide is separated in the carbon dioxide separator and which is expelled therefrom, with the fuel gas produced by the fuel vaporizer being supplied to the fuel electrode of the fuel cell.

10 2. The fuel cell system according to claim 1, wherein the carbon dioxide separator has a carbon dioxide removing member that absorbs and releases the carbon dioxide in dependence on a temperature of the anode exhaust gas.

3. The fuel cell system according to claim 2, wherein the carbon dioxide separator includes an anode exhaust gas flow passage, communicating with the fuel electrode of the fuel cell, and a

15 cathode exhaust gas flow passage, communicating with the fuel electrode of the fuel cell, the anode exhaust gas flow passage and the cathode exhaust gas flow passage being separated from one another by a wall section,

and wherein the carbon dioxide removing member is rotatably disposed in a way to cover both of the anode exhaust gas flow passage and the cathode exhaust gas flow passage such that

20 the carbon dioxide is absorbed at a temperature below a predetermined value whereas the carbon dioxide is released at a temperature exceeding the predetermined value.

4. The fuel cell system according to claim 3, further comprising a heat-exchanger disposed in the anode exhaust gas flow passage at an upstream side of the carbon dioxide removing member to cool the anode exhaust gas.

25 5. The fuel cell system according to claim 4, wherein the heat-exchanger performs heat-exchange with the anode exhaust gas using air supplied from an air compressor to decrease a temperature of the anode exhaust gas, and the air passing through the heat-exchanger is supplied to the air electrode of the fuel cell.

6. The fuel cell system according to claim 3, wherein the wall section of the carbon dioxide 30 separator has a heat insulating property at an upstream side of the carbon dioxide removing

member.

7. The fuel cell system according to claim 3, wherein the anode exhaust gas flow passage and the cathode exhaust gas flow passage of the carbon dioxide separator communicate with an anode exhaust gas flow passage and a cathode exhaust gas flow passage at downstream sides of the carbon dioxide removing member, respectively, and the anode exhaust gas flow passage and the cathode exhaust gas flow passage prevailing at the downstream sides of the carbon dioxide removing member are separated from one another by a wall section having a thermal conductivity.  
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8. The fuel cell system according to claim 7, wherein the fuel vaporizer injects the fuel into the anode exhaust gas flow passage at the downstream side of the carbon dioxide removing member to form the fuel gas.  
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9. The fuel cell system according to claim 4, wherein the heat-exchanger performs heat-exchange with the anode exhaust gas using the fuel gas vaporized in the fuel vaporizer to decrease a temperature of the anode exhaust gas, and the fuel gas passing through the heat-exchanger is supplied to the fuel electrode of the fuel cell.  
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10. The fuel cell system according to claim 9, wherein the heat-exchanger includes a reformer device that causes reforming reaction in endothermic reaction.
11. The fuel cell system according to claim 10, wherein the reforming reaction of the heat-exchanger involves steam reforming reaction.
- 20 12. The fuel cell system according to claim 1, further comprising an exhaust gas combustor disposed in the cathode exhaust gas flow passage of the carbon dioxide separator at an upstream side of the carbon dioxide removing member, a portion of the anode exhaust gas exhausted from the fuel electrode of the fuel cell being supplied into the combustor.
13. A fuel cell system comprising:  
25     a fuel cell having a fuel electrode supplied with fuel gas and an air electrode supplied with oxidizer gas;  
          carbon dioxide separating means for separating carbon dioxide from anode exhaust gas expelled from the fuel electrode of the fuel cell; and  
          fuel injecting means for injecting fuel into the anode exhaust gas, whose carbon dioxide is  
30     separated in the carbon dioxide separating means and which is expelled therefrom, to produce

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gas, with the fuel gas produced by the fuel injecting means being supplied to the fuel electrode of the fuel cell.

14. A method of circulating gas in a fuel cell system provided with a fuel cell having a fuel electrode supplied with fuel gas and an air electrode supplied with oxidizer gas, the method comprising:

separating carbon dioxide from anode exhaust gas expelled from fuel electrode of a fuel cell;  
producing fuel gas by injecting fuel into the anode exhaust gas, whose carbon dioxide is separated and which is expelled; and  
supplying the fuel gas into the fuel electrode of the fuel cell.

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